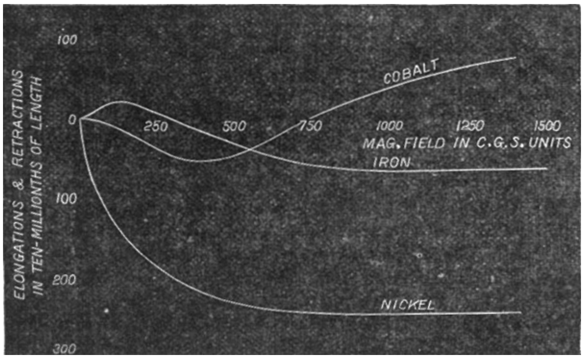
effect, and that it was only when the current was diminished by increasing the resistance of the battery that the elongation of the iron became well developed. This view clearly involved the assumption that the common notions as to magnetic saturation must be at least in part erroneous, and I therefore endeavoured to find some other explanation of the apparent anomaly. In particular, I suspected that it might be due to electro-magnetic action of the kind known as "solenoidal suction" between the iron rod and the coil; but a few careful experiments convinced me that, although this might well have been the case, yet in fact it was not so. Nor did any other hypothesis present itself which would bear examination, and I accordingly fell back upon the first and natural interpretation of the facts, which implies that magnetizing force may exert an important molecular influence upon iron even when its magnetism is saturated.

A fuller investigation of the phenomenon was then made with very delicate apparatus and greater battery power, and the results were communicated during the next year to the Royal Society, the principal conclusion arrived at, so far as regards iron, being the following: When an iron rod is subjected to a continually increasing magnetizing force, its length at first increases to a maximum and then diminishes, ultimately becoming actually *less* than when the rod is unmagnetized.

I have since published accounts of further experiments, and amongst others of a series in which iron rings surrounded by magnetizing coils were used instead of straight rods. The changes produced by magnetization in the diameter of the rings were of exactly the same nature, showing conclusively that the effects before observed could not have been due to any unexplained action of the ends of the rods.



By the kindness of Mr. W. H. Preece, F.R.S., who placed at my disposal the large secondary battery used in lighting his house at Wimbledon, I have recently been able to repeat some of my experiments with magnetic fields of exceedingly high intensity. Rods of iron, nickel, and cobalt were thus tested, and the results are clearly shown in the accompanying curves, where the abscissæ represent the magnetic fields due to the coil in C.G.S. units, and the ordinates the elongations and retractions of the rods in ten-millionths of their lengths.

The retraction of iron, it will be seen, becomes ultimately greater in amount than its maximum elongation, and reaches a limit in a field of 1000 or 1100 units, after which its curve becomes sensibly parallel to the horizontal axis. Nickel, unlike iron, retracts[1] from the very commencement, rapidly at first and afterwards more slowly, until in fields of 800 units and upwards its length becomes apparently constant. Cobalt behaves in a very remarkable manner. While the field is comparatively weak, no sensible change in either direction can be detected. After about 50 units of magnetizing force, the rod begins to contract, attaining its minimum length with 300 or 400 units. But instead of remaining unchanged in fields stronger than this, it again becomes longer. At 750 it regains its original length, and thence up to 1400, the highest field reached in the experiment, it continues to elongate steadily.

It should be understood that so far as mere details are concerned the curves in the diagram relate only to particular specimens of the metals in question. With different rods there will be certain small variations, dependent upon the purity of the metals and their physical condition. But I have always found that under increasing magnetizing force iron is at first extended and then contracted, nickel is contracted from the beginning, while cobalt is first contracted and afterwards extended.

My best thanks are due to Mr. Preece, not only for having given me the opportunity of carrying out the experiments described above, but also for the exceedingly kind and cordial manner in which he did so.

SHELFORD BIDWELL.

A METEOROLOGIST AT THE ROYAL ACADEMY.

ARTISTS and poets are supposed to draw their inspirations from communing with Nature; but it is well known that painters in oil are rarely successful with the cloud portion of their pictures.

For some reason or other, skies and clouds are always far more satisfactory in the water-colour exhibitions than in galleries devoted to oils. The transparency of the former medium enables a painter to put an amount of detail into his clouds which would make the sky far too heavy if attempted in oil; so there is no doubt that oil as a medium is peculiarly unsuitable for the reproduction of cloud-forms, and that the utmost skill is required to give even passable results.

Painters generally do pretty well when they only try to represent shading of the sky, or what Mr. Lockyer has called the zoning of colour in the heavens. They can paint the blue sky overhead gradually getting whiter and grayer as you approach the horizon, or the red round the horizon at sunset surmounted by a zone of orange shading through green into the blue above, as only shade and colour have to be rendered. But when artists try to delineate the form, and, still more, the texture, of clouds, the difficulties are so great that few painters attain excellence in this branch of their work.

Few have yet learnt that, putting the difficulties of the medium aside, the structure of a cloud has an anatomy as definite as that of a man; and that the perspective of cloud-forms obeys the same laws as that of bodies on the earth's surface. Everybody paints ordinary objects so as to show a characteristic texture or structure: the silk dress, the woollen carpet, the wooden floor, are all carefully distinguished; but how many realize the essentially different structure of cloud-forms—the hairy cirrus, the lovely fleecy sky, or the rocky masses of cumulus? Nobody would dare to draw a building, a road, or a tree out of its due perspective; but many seem to think that the forms and distances of the sky can be rendered by daubing white and blue and gray promiscuously over the canvas.

The chapters on clouds in Mr. Ruskin's "Modern Painters" sin against every canon of literature. They are disjointed, discursive, irrelevant, and wander into many by-paths; for one note brings in the causes of the failure of the Reformation in Germany, and the whole ends with a commentary on the nineteenth Psalm. But, in spite of all this, they preach in brilliant and poetic language the two great truths that clouds have distinctive characteristic structures, and that their perspective must be as carefully drawn as that of a building. In one of the illustrations—that of the tower of Beauvais Cathedral in front of a thundery sky—is the finest delineation of cloud in line that has yet been produced; and though Mr. Ruskin's writings have had a powerful influence on contemporary art in England, the following notes on the pictures now hanging on the walls of the Royal Academy will show that much still remains to be done before British artists have exhausted the possibilities of cloud-painting.

---

[1] The retraction of nickel under magnetization was first observed by Prof. Barrett (NATURE, xxvi. 585).

The great landscape of the year is undoubtedly Sir J. Millais' "Murthly Moss" (No. 292), and readers will naturally ask, Is the sky good? The answer is, unequivocally, Yes. Our great artist has selected a somewhat rare form of sky, but one which is most useful in giving distance and perspective to a picture. As a whole, the sky is covered with a sheet of thin flat cloud; but, while the top of the picture appears uniform, the sky lower down looks as if it were composed, or made up, of parallel bars, which get thinner and thinner as they approach the horizon.

If a series of disks stretched in a line from nearly overhead to the horizon, at a uniform height of about 10,000 feet, we should see the whole under-surface of those overhead; and progressively less and less, till on the horizon the thin edges of the disks only were visible, like straight bars. This is exactly what happens in Nature when a thin flat sheet of cloud is broken into irregular flakes. Above, there is only visible the flat, formless under-surface, while in the distance the thin edges of the flakes appear more and more like bars. Thus the picture of the sky alone gives instinctively the idea of retreating distance.

Turner, curiously enough, hardly ever painted cumulus, but almost always a coarser form of this flaky sky growing into thinner and thinner bars towards the horizon; and I have seen pictures by Mr. Leader, in which the same device was used for giving distance, with great effect. In Millais' picture the artist has painted the sky with consummate skill, true to Nature, and true to art in not destroying the balance of relative distance.

Another important landscape is No. 102, Mr. G. Boughton's "A Golden Afternoon." But in this the sky is scarcely satisfactory. The clouds are rather spotty, but yet not of the kind which come in flocks of little cloudlets; and it is difficult to make out either the precise form which it is intended to delineate, or the perspective of the whole sky. The reproduction of representative structure is simply nowhere, for at a distance neither form nor structure are discoverable; while close at hand the brush-marks are so apparent that the lower clouds appear to have a fibrous structure. This would be practically impossible, for though the summit of a rocky cumulus is often combed out into hairy cirrus, the rest of the cloud remains firm, and this would not occur on "a golden afternoon."

Mr. Leader can be complimented on sending three first-rate skies in the three pictures which he contributes to the exhibition. In No. 408 he not only paints "An Old English Homestead," but also a truly English sky. A wisp of cirrus floats over a well-painted cumulus, while the ideas of relative height and distance are well given. Cloud forms are essentially the same all over the world, but the details differ; and if the sky in this picture were alone, I could say that it was nowhere in the tropics, but somewhere in a temperate zone. In No. 638, "A Summer Day"—

> "When the south wind congregates in crowds
> The floating mountains of the silver clouds"—

Mr. Leader again paints the same kind of sky very beautifully; but in No. 421, over "The Sands of Aberdovey," he gives a totally different type of cloud. Here the clouds float as a thin white fleece on the sky, with some small raggy, evaporating cloud of a totally different structure at a lower level. The effect is very striking, and the accurate drawing of the forms gives height and distance to the picture.

Mr. V. Cole's "The Pool of London" (No. 350) has been purchased under the Chantrey bequest. This is a large, fine picture, in which the artist has employed a device for giving distance that was sometimes used by Turner. A dark mass of cumulus cloud on either side of the sky leaves a sort of bright vault running down the centre, in which high white clouds lead the eye to the dome of St. Paul's in the distance. The painting of all the clouds, and the effect of their floating at different levels, are very good; but somehow the scale of distance in the picture is scarcely satisfactory. Artists are conventionally allowed to diminish the size of objects in the foreground, and to increase that of distant objects so as to improve the effect; but the modern eye, which is trained to the accurate projection of objects at different distances given by photography, knows that in this picture the ships in the foreground should be bigger, and the Cathedral dome smaller than they are here delineated.

"Then came the Autumn, all in yellow clad," is the poetic title of Mr. G. Lucas's picture (No. 342). A beautiful, finely-painted shower-cloud, in the shape of a rising, driving cumulus, gives such an idea of space and height that it is a pleasure to look at such a truthful transcript of Nature. This is one of the best skies in the exhibition.

Close by, and in great contrast to the above, but fortunately well skied, hangs a small landscape which contains a sky of the worst possible description. White and blue and gray are patched about the canvas promiscuously, regardless of form or drawing or perspective; and the artist seems to consider that any mixture of these colours represents a cloud-covered sky.

Artists do not often break a lance with men of science, but Mr. J. Brett has run a tilt against the astronomers and geologists. One of his pictures of this year is an ambitious subject—"The Earth's Shadow on the Sky: the Rising of the Dusk." A short time after sunset in fine weather, the shadow of the earth appears to rise from the eastern horizon, like the segment of a leaden-gray arch; but there is little to suggest this on Mr. Brett's canvas, though the general effect of the picture is very pleasing. A bright green sea fills up the foreground, then comes a line of gray mist in shadow, with blue hills above; while the zoning of a gilded sunset sky from red through orange to blue is very skilfully handled. But the low mist is more characteristic of sunrise than sunset; and the sky appears to us very bright to be opposite the sun. This artist also shows a well-painted shower-cloud in "A Heavy Squall off the Start Lighthouse," and a confused cumulus in a slightly finished work entitled "The Bristol Channel."

In "Nearing the Needles—Return of Fine Weather after a Gale," Mr. H. Moore exhibits a pretty picture, with a lovely sea and sunlit chalk cliff; but the clouds are not very well defined; and are rather soft for the rear of a gale. The Needles appear to lie to the east of the observer, while the sea and ships appear to be running from south-east. If this is so, the sky has far more the character of a north-west than of a south-east wind. Another of Mr. Moore's pictures—"A Breezy Day in the Channel"—brings into evidence the great difficulty of painting clouds carefully, and yet of maintaining the balance of the picture. Here the clouds—irregular cumulus—are very good in form, and beautifully painted; but this careful work makes them so heavy that they appear rather too near. An artist's scale of distance is to a certain extent a scale of distinctness; so that when clouds are painted in minute detail, it is very difficult not to make them appear too near. The same criticism applies to this painter's "Westward," where another beautiful sky, correct both in form and perspective, is a good deal too heavy.

The low, ill-defined cumulus in Mr. Hook's "Low-Tide Gleanings" are not more finished than the rest of the picture, but are correct both in form and drawing; and the same remarks apply to his work, "A Day for the Lighthouse."

"Thanet Cliffs in the Time of Peace," by Mr. S. Cooper, shows a good cumulus with cirrus overhead; but in Mr. C. Hunter's "Fishers of the North Sea" the cumulus cloud is not satisfactory.

Mists on a mountain, with a gray sky, are very well painted in Mr. Faed's "And with the Burden of Many Years," and make an effective background to a striking work of art; while in "The Approach to Bealloch-na-ba" Mr. H. Davis has delineated mountain mist with equally good effect.

Mr. P. Graham's "A Norfolk River" contains a very good showery sky, but the brush-marks give an appearance of fibrous structure which would not be in Nature; while his "Driven by the Wind" contains an effective mass of gray nimbus or rain-cloud.

Mr. W. Shaw paints a good misty yellow-tinted sky in his "Tide Race"; but the great mass of cumulus behind Sir F. Leighton's central figure of the "Captive Andromache" is not very satisfactory.

The sky in "The Old Water-Way," by T. Liddell, is good so far as form is concerned, but is painted so heavily that the clouds look like clods. Philologists say that the word cloud is really derived from clod, but artists should not express that idea in their works. There is a rainbow in this picture, so ill defined that it is difficult to make out the succession of tints; though I think the red is meant to be outside, which is correct.

Mr. R. Rouse's "Pasture-land in Kent" would be much more pleasing if the clouds were more carefully painted, and not so like patches on the sky. In No. 553, Mr. H. Wells is to be complimented on having painted rays diverging from the sun from exactly the proper kind of sky. These rays are rarely seen except through a peculiar, flat, broken cloud; but they are usually associated with a firmer, harder sky than is here depicted.

Lastly, Mr. C. Johnson paints the "Plain of Arundel" under two well-drawn layers of cloud; and Mr. J. MacWhirter has hit off with great skill and accuracy a flat, broken cloud, lit from below by a setting sun, beside the picturesque castle of "Edinburgh."

Such are some of the more notable skies in our great national exhibition of pictures, and it will be seen at once that the best skies are painted as a rule by those who have achieved the greatest success in the other elements which make up a good picture. May we not therefore fairly conclude that part of their success is due to their faithful rendering of skies and clouds; and that it behoves those who wish to attain a high place among landscape painters to study the form, the structure, and the perspective of those clouds which give life, and height, and distance, to every picture? RALPH ABERCROMBY.

THE OXFORD UNIVERSITY OBSERVATORY.

THE following are the principal parts of the Thirteenth Annual Report of the Savilian Professor of Astronomy to the Board of Visitors of the University Observatory, read June 6, 1888:—

I. *Lectures.*—In addition to the requisite statutable lectures, Prof. Pritchard has offered some others of a more elementary and quasi public character on descriptive astronomy, and expressed as far as possible in untechnical language. He has been so much encouraged by the interest manifested in these lectures that he proposes to offer another and perhaps more extended series on the recent speculations as to the origin of the Cosmos from meteoric collision and on matters cognate therewith.

II. *Instruments.*—The De La Rue equatorial is in excellent order; its mechanical mounting is now equal to the delicate purposes of stellar parallax to which it has been uninterruptedly applied during the last twelve months. Although the mirror is perhaps somewhat dimmed with age, its figure, which has been recently tested by comparison with the presumed best productions of the day, retains its original very remarkable character.

The two mirrors mentioned in the last Report have been mounted temporarily on the large equatorial for the purpose of the comparison of their photographic action. An efficient electric control contrived by Sir H. Grubb has also been added with the view of securing the great accuracy necessary in the movement of the telescope. The work for which the mirrors were intended having been completed, they have now been dismounted.

Dr. De La Rue having provided the funds necessary for a photographic telescope of 13 inches aperture and of the pattern suggested at the Paris Conference of 1887, the large equatorial has been sent to Sir H. Grubb at Dublin, for the purpose of attaching thereto the instrument in question, and of carrying out the other considerable alterations necessary for the photographic charting of the heavens, as proposed at the aforesaid Conference.

The transit-circle is in perfect order.

III. *Buildings.* — Mr. Nasmyth has presented his magnificent picture map of the moon for the service of the Observatory. This very beautiful work of art (6 feet in diameter) was completed by Mr. Nasmyth from actual observation with a large telescope of his own construction in 1849.

IV. *Astronomical Work.*—During the past year this has been twofold. In the first place continuous attention has been devoted to the photography of small portions of the heavens with the view of determining the parallax of certain selected stars. In the first instance a careful trial of the method was made on the parallax of 61^1 and 61^2 Cygni, because the parallax of the point midway between the two stars had been determined, with presumedly great accuracy, by Bessel in 1838, whereby effective means of comparing the two methods were supplied. The general agreement of the result obtained from photography with that determined by this most able astronomer, together with the remarkable consistency of the individual photographic measurements, satisfied Prof. Pritchard not only of the great convenience, but also of the unimpeachable accuracy of the method. Dr. Pritchard has consequently much extended these operations for stellar parallax, and before the termination of the present year he hopes that the computation of the parallaxes of altogether some ten or twelve stars will be completed. The list will comprise 61^1 and 61^2 Cygni, μ Cassiopeiæ, and Polaris, which four stars may be regarded as already completed. Three more parallaxes have been *provisionally* determined from observations of *six months*,* viz. α, β, γ Cassiopeiæ; four others also are in a forward state. Experience has suggested that these stellar parallaxes will be most readily and efficiently determined by confining the photographic work on each star to those four periods of the year which, in respect of each parallactic ellipse, are the most effective for the purpose. It should be stated that for the purposes of accuracy four stars of comparison are selected, instead of the two with which astronomers have hitherto been generally contented. This photographic process enables Prof. Pritchard also, without much consumption of time, to measure from night to night the distance between the stars of comparison themselves, thus furnishing a check to the unavoidable variability of the scale of the focal field and of the photographic film. These operations are at present restricted to a systematic catalogue of stars of the second magnitude. It appears that astronomical work like this is well adapted to an Observatory connected with a great